Electronic Version

Stylesheet Version v1.1.1

Claims

[c1] A wavelength locked thermally tunable laser comprising:

A semiconductor laser, whose output wavelength adjusted thermally and continuously;

A wavelength locker comprising:

(a) an etalon;

(b) a first photo detector for detecting the collimated light transmitting through the said etalon;

(c) a second photo detector for detecting the power output from the said semiconductor laser;

The said semiconductor laser and the said locker packaged on one single platform;

The temperature of the said platform, the said semiconductor laser and the said etalon adjusted by a thermal electrical cooler;

A temperature detecting element disposed near the said etalon for detecting the ambient temperature of the said etalon;

A process of locking the wavelength of the said semiconductor laser to a specific wavelength by an outside electronic controller comprising:

(a) to calculate the ratio of the said first detector to the said second detector,

(b) to compare the ratio to a pre-set locking point value calibrated at an output wavelength and temperature,
(c) to adjust the temperature of the said laser diode to change its output wavelength to let the calculated ratio to be equal to the pre-set locking point value,
(d) to adjust the said pre-set locking point value according to the measured temperature to get an adjusted pre-set locking point value,
(e) to adjust the temperature of the said laser diode to change its output wavelength to let the calculated ratio to be equal to the adjusted pre-calibrated locking point value.

[c2] A wavelength locked thermally tunable laser of claim 1 wherein the etalon with a free spectrum range FSR or physical thickness t(T) at a temperature Tis defined by a first partial reflector and a second partial reflector, said reflectors formed on the two parallel surfaces of a piece of transparent material.

[c3] The etalon of claim 2 wherein the FSR of the etalon is determined by the formula $FSR=\Delta\nu-\Delta\nu/(d\nu/dT)_{laser}\cdot(d\nu/dT)_{etalon}$, where the $\Delta\nu$ is the channel spacing, such as 100GHz, 50GHz, $(d\nu/dT)_{laser}$ the temperature dependence of the emission frequency of the semiconductor laser, and $(d\nu/dT)_{etalon}$ the temperature dependence of the etalon resonance peak frequency.

[c4] The etalon of claim 2 wherein the physical thickness d(T) of the etalon is calculated by $t(T_1)=[L\lambda_1\lambda_2+2n(\lambda_2, T_2)\alpha\Delta T\lambda_1]/[2n(\lambda_1, T_1)\lambda_2-2n(\lambda_2, T_2)\lambda_1]$, where λ_1 is the output wavelength at temperature T_1 of the said semiconductor laser, $\Delta\lambda$ is the channel spacing corresponding to 100GHz, 50GHz etc., $\lambda_2=\lambda_1+L\Delta\lambda$ is the output wavelength at T_2 of the said semiconductor laser, α is the thermal expansion coefficient of the material of the said etalon, L is an integer(=1, 2, ...), $\Delta T=T_2-T_1$ is the temperature change required to change the output wavelength from λ_1 to λ_2 of the said semiconductor laser.

[c5] A wavelength locked thermally tunable laser of claim 1 wherein to adjust the said pre-set locking point value according to the measured temperature means that when the temperature finely changes from T to $T_{'}$, the locking point value P for a channel wavelength λ at temperature T is adjusted by an amount of [I(λ, T)-I(λ, T')] to the locking point value at temperature T', where I(λ, T) is the normalized (against the power fluctuation) transmission intensity of the said etalon at the wavelength λ and the temperature T and I(λ, T') is the normalized transmission intensity of the said etalon at the wavelength λ and temperature T'.